Remarks

Claims 1-7 are pending in the application. Claims 1-7 are rejected. The rejections are respectfully traversed. The specification is amended to correct informalities.

The Examiner rejected claim 1-4 under 35 U.S.C. 103(a) as being unpatentable over Stegmann et al. (US 6,415,050 – "Stegmann") and Sukthankar et al. (US 6,618,076).

Stegmann only describes a laser projector system. At any one time, a laser projects a single laser point. To project multiple points, the laser source must move. Therefore, Stegmann must monitor the relative position of the laser source of the Laser Projection system and an object surface while projecting.

In contrast, the claimed invention uses image based projection. Image based projection is fundamentally different than laser projection in two ways. First, the projector is at a **fixed** location with respect to the object. Second, the calibration image includes a plurality of pixels that are all displayed simultaneously.

Because of these two differences, the calibration techniques used by Stegmann cannot be applied to what is claimed: "illuminating the object with a calibration image using a projector at a *fixed* location with respect to the object, the calibration image including *a plurality of calibration pixels*."

Furthermore, Stegmann cannot align a calibration image including a plurality of pixels with each of the 3D calibration points on the surface of the 3D physical

object to identify corresponding 2D calibration pixels in the calibration image. Stegmann has no pixels of any kind.

For the same reason, Stegmann cannot determine a transformation between the 2D calibration pixels and the corresponding 3D calibration points of the model to register the projector with the 3D physical object.

Sukthankar describes a projector-camera calibration system. However, there "calibration patterns are projected onto a **flat** surface." In contrast, Stegmann (as well as the invention) requires the projection of a calibration pattern onto a 3D physical object. Sukthankar cannot be combined with Stegmann. Those of ordinary skill in the art would understand that methods for calibrating 2D surface are totally useless for calibrating 3D objects.

Claimed is method for "determining a transformation between the 2D calibration pixels and the corresponding 3D calibration points of the model to register the projector with the 3D physical object.

The transformations described by Sukthankar are strictly two-dimensional, only (X, Y) coordinates are considered, see equations in columns 4, lines 28-67. There are no Z coordinates there. Sukthankar cannot handle variations in depth on the surface of the object to be calibrated. This requires a transform that is in the form a 3x4 perspective projection matrix up to scale.

Furthermore, the claimed invention includes a projector transformation matrix and a viewer transformation matrix. These are not described by any of the cited references.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stegmann et al. and Sukthankar et al., and further in view of Penkethman (US 6,549,649).

Penkethman describes a calibration method for two **imaging** systems. The desired calibration is between a projector and a camera. Penkethman does no reveal how a calibration for imaging systems can be applied to a projector and a camera, nonetheless, where the surface against which the camera and projector are calibrated are in 3D.

Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stegmann et al. and Sukthankar et al., and further in view of Mizushima et al. (U.S. 5,988,817).

Like Sukthankar, Mizushima operates in 2D. Mizushima is incompatible with Stegmann (and the invention). There, multiple projectors project images onto a flat screen. Mizushima does not describe illuminating a 3D object with a plurality of calibration images, aligning each calibration image with each of the 3D calibration points on the surface of the 3D physical object to identify corresponding 2D pixels in each calibration image, and determining a transformation between the 2D calibration pixels of each image and the corresponding 3D model calibration points to register each projector with the 3D physical object.

Neither does Mizushima describe rendering the 3D graphics model using each transformation to generate a plurality of images, and illuminating the 3D physical object with the image in parallel using the plurality of projector at the plurality of fixed location.

The Examiner states that Mizushima describes a projection employing a plurality of projectors. That is correct. However, the Examiner does not state that Mizushima describes **any** of the elements in claims 6 and 7. Therefore, the rejection of claims 6 and 7 should be withdrawn.

All rejections have been complied with, and applicant respectfully submits that the application is now in condition for allowance. The applicant urges the Examiner to contact the applicant's attorney at phone and address indicated below if assistance is required to move the present application to allowance.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 50-0749 and please credit any excess fees to such deposit account.

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